

REMARKS

Claims 1-15 and 67 are pending in the present application. Applicants have added claims 68 and 69, and have amended claims 1-15 and 67 to clarify certain aspects of the inventions defined by these claims without change in the substantive scope thereof (e.g., adding "by weight" as compositional basis, and/or correcting antecedent basis), and in some claims, to more particularly point out and distinctly claim the invention.

Added claims 68 and 69 are supported throughout the specification. See, e.g., page 7, lines 18-26.

The amendments do not constitute new matter.

Applicant requests reconsideration of the above-identified application in view of the foregoing amendments and the following remarks.

I. Double Patenting Rejections

1. The Examiner has provisionally rejected claims 1-15 and 67 under the judicially created doctrine of obviousness-type double patenting, as allegedly being unpatentable over claims 1-55 of United States Patent 6,355,854.

In order to overcome this rejection, applicant will file a Terminal Disclaimer in compliance with 37 C.F.R. § 1.321(c) upon notice that the claims are otherwise in condition for allowance.

2. The Examiner has provisionally rejected claims 1-15 and 67 under the judicially created doctrine of obviousness-type double patenting, as allegedly being unpatentable over claims 1-39, 41-44, 46-77, 74, 78, 79, 81-88, and 99 of copending United States application 09/510,458.

In order to overcome this rejection, applicant will file a Terminal Disclaimer in compliance with 37 C.F.R. § 1.321(c) upon notice that the claims are otherwise in condition for allowance.

II. Claim Objections

The Examiner has objected to claims 1 and 67 for informalities. In particular, the Examiner states that the expression "about 50% nickel oxide" in claims 1 and 67 lacks a unit.

Applicant has amended claims 1 and 67 to make clear that the expression refers to the amount of nickel oxide by weight in the catalyst. This amendment is supported by the

specification. See, e.g., specification page 5, lines 21-22. The amendment overcomes the Examiner's objection.

III. Rejections under 35 U.S.C. § 112, First Paragraph

1. The Examiner has rejected claims 1-15 under 35 U.S.C. § 112, first paragraph, as allegedly lacking enablement.

In particular, the Examiner asserts that "the specification, while being enabling for a dehydrogenation process having selectivity of greater than 70% and a conversion of greater than 10% by using a catalyst having a **specific composition** of Ni, Nb, Ta, K and Co at a **specific operating temperature**, does not reasonably provide enablement for a dehydrogenation process having selectivity of greater than 70% and a conversion of greater than 10% by using a catalyst containing a **nickel oxide** at a non specific [sic] **operating temperature.**" Office Action, page 4 (emphasis in original). The Examiner concludes that the entire scope of the claims is not enabled by the specification because the claimed process does not include the effective operating temperature and the composition of each metal oxide that gives the selectivity of greater than 70% and the conversion of greater than 10%. Applicant traverses in view of the

amendments to the claims, considered together with the following remarks.

Applicant respectfully submits that the scope of claims 1-15 are enabled by the specification. Applicant teaches high performance methods for dehydrogenating an alkane using a catalyst that includes nickel oxide as a major component (specification page 3, lines 25-26 and page 4, line 30 through page 5, line 3). Applicant also teaches preferred reaction conditions for converting an alkane to an alkene (specification page 4, line 30 through page 5, line 3 and page 7, lines 18-26), as well as preferred catalysts for converting an alkane to an alkene (specification page 5, line 7 through page 6, line 15). Consistent with such teaching, applicant has amended the claims so that each of the pending claims requires a catalyst composition comprising at least about 50% nickel oxide by weight. Independent claim 6, claims depending therefrom, and new claims 68 and 69 also require that the alkane dehydrogenation reaction be effected at a temperature of about 400 °C or less.

Moreover, applicant has specifically exemplified the preparation and reactivity of a number of nickel oxide catalysts with alkanes. See, Examples 1-14, specification page 10, line 15 to page 22 line 20). Indeed, applicant has

demonstrated the reactivity of 83 catalysts containing at least 50% nickel oxide in a dehydrogenation process that produces a selectivity of greater than about 70% and a conversion of greater than about 10%. See, Tables 4, 7, 13, 22, 30, 38 and 47. In fact, of those 83 catalysts, 39 produce a selectivity of greater than 85%. Thus, the specification would have taught a person of ordinary skill in the art how to make and use the full scope of the invention, as presently claimed, without undue experimentation.

In rejecting claims 1-15, the Examiner unduly restricts the enabled subject matter to applicant's preferred embodiments and working examples. Such a restriction is unreasonable given the level of knowledge and skill in the art, and in light of the substantial teaching and extensive data set forth in the specification. Practical operating conditions, e.g., specific operating temperatures and specific nickel oxide catalyst compositions, can be readily determined by the skilled artisan without undue experimentation. Because such practical operating conditions are within the level of the skilled artisan, the claims need not recite them. In re Skrivan, 427 F.2d 801, 806, 166 USPQ 85, 88 (CCPA 1970).

In addition to the rejections being contrary to the facts and the law, the Examiner has also not satisfied his burden of showing that claims 1-15 are not enabled by the disclosure. As explained by the Court in In re Marzocchi, 439 F.2d 220, 169 USPQ 367 (CCPA 1971) :

"... a specification disclosure which contains a teaching of the manner and process of using the invention in terms which correspond in scope to those used in describing and defining the subject matter sought to be patented must be taken as in compliance with the enabling requirement of the first paragraph of § 112 unless there is reason to doubt the objective truth of the statements contained therein...."

The decision also states:

"... it is incumbent upon the Patent Office, whenever a rejection on this basis is made, to explain why it doubts the truth or accuracy of any statement in a supporting disclosure and to back up assertions of its own with acceptable evidence on reasoning which is inconsistent with the contested statement."

Applicant's disclosure teaches how to make and use the invention. The Examiner has not provided any objective or scientific reason to the contrary. Thus, such disclosure must be taken as being in compliance with the enablement requirement of 35 U.S.C. § 112, first paragraph.

2. The Examiner has rejected claims 1-5 and 67 under 35 U.S.C. § 112, first paragraph, as allegedly lacking enablement. In particular, the Examiner asserts that "oxygen ... is critical or essential to the practice of the invention" and "is not included in the claims(s)...". Office Action, page 4. Applicant traverses.

The Examiner's assertions are separately addressed below with respect to: (1) claims 1-5; and (2) claim 67.

(1) Claims 1-5

Contrary to the Examiner's assertion, oxygen is not critical or essential to the methods of claims 1-5. The skilled artisan would readily acknowledge that nickel oxide compounds are known as active dehydrogenation catalysts both, in the presence and absence of oxygen.

Moreover, the Examiner appears to limit applicant's claimed process to a preferred embodiment, i.e., an alkane dehydrogenation method in the presence of oxygen. The Examiner's limitation would unduly restrict the scope of applicant's invention. On this point, the court in In re Goffe, stated:

"... to provide effective incentives, claims must adequately protect inventors.

To demand that the first to disclose shall limit his claims to what he has found will work or to materials which meet the guidelines specified for "preferred" materials in a process ... would not serve the constitutional purpose of promoting progress in the useful arts." In re Goffe, 542 F.2d 564, 567, 191 USPQ2d 429, 431 (CCPA 1976).

Accordingly, the recitation of oxygen in claims 1-5 is not required under 35 U.S.C. § 112, first paragraph.

(2) Claim 67

Without acquiescing to the Examiner's rejection, applicant has amended claim 67 to recite oxygen in the claimed process. This amendment renders the rejection moot.

IV. Rejections under 35 U.S.C. § 112, Second Paragraph

1. The Examiner has rejected claims 1-15 and 67 under 35 U.S.C. § 112, second paragraph, as allegedly being indefinite. In particular, the Examiner asserts that the "expression 'at least **about** 50% nickel oxide' in lines 2 and 3 of claims 1 and 67 renders the claims indefinite because the expression includes values above and below 50% (emphasis in original)." Office Action, page 5. Applicant traverses.

Recitation of the word "about" along with the specified range does not render the claims unclear or

indefinite. To the contrary, the word "about" has been deemed acceptable claim language. "The descriptive word 'about' is not indefinite as argued by the examiner Rather, the term is clear but flexible and is deemed to be similar in meaning to terms such as 'approximately' or 'nearly.'" Ex Parte Eastwood, 163 USPQ 316, 317 (Bd.Pat.App. 1968). See also Kolene Corp. v. Motor City Metal Treating, Inc., 307 F.Supp. 1251, 1258 (E.D. Mich. 1969), aff'd, 440 F.2d 77 (6th Cir. 1971), cert. denied, 404 U.S. 886 (1971) ("As a matter of law, the term 'about' is a clear warning that exactitude is not claimed but rather a contemplated variation.").

Thus, applicant's use of the word "about" to modify the claimed range does not render the claim indefinite. Accordingly, applicant requests that the Examiner withdraw the 35 U.S.C. § 112, second paragraph rejection.

2. The Examiner has rejected claim 67 under 35 U.S.C. § 112, second paragraph, as allegedly being indefinite. In particular, the Examiner asserts that the expressions "(NiO)," "(Nb₂O₅)", and "(Ta₂O₅)" render the claim indefinite because "it is unclear whether the limitation(s)

in parentheses are part of the claimed invention." Office Action, page 5.

Applicant has obviated the rejection by deleting the objected to expressions.

V. Rejections under 35 U.S.C. § 102

The Examiner has rejected claims 6-8 and 10 under 35 U.S.C. § 102(b), as allegedly being anticipated by United States Patent 4,524,236 ("McCain"). The Examiner asserts that McCain "discloses an oxidative dehydrogenation process of ethane to produce ethylene by contacting the ethane feed with a catalyst comprising nickel oxide at a temperature less than or equal to 400°C" and that McCain's "process is performed at a conversion of 70% and a selectivity greater than 80%." Office Action, page 5. Applicant traverses.

McCain does not disclose the nickel oxide catalysts employed in amended claims 6-8 and 10. In particular, McCain's catalysts have the composition $Mo_aV_bNb_cSb_dX_e$, where "a" is 0.5 to 0.9, "b" is 0.1 to 0.4, "c" is 0.001 to 0.2 and where "X" may be nickel oxide. Therefore, the maximum value of "e" in the composition is less than 0.4, which is equivalent to a material containing less than about 40%

nickel oxide. In contrast, the methods of amended claims 6-8 and 10 require a catalyst that includes at least about 50% nickel oxide. Because McCain fails to teach a catalyst that contains at least about 50% nickel oxide, it fails to anticipate the claims of the present invention. Accordingly, applicant requests that the Examiner withdraw the 35 U.S.C. § 102(b) rejection.

V. Rejections under 35 U.S.C. § 103(a)

The Examiner has rejected claims 1-5, 11-13 and 15 under 35 U.S.C. § 103(a), as allegedly being unpatentable over Ji et al., React. Kinet. Catal., 62(1), pp. 121-128 (1997) ("Ji").

In particular, the Examiner asserts that "Ji discloses an oxidative dehydrogenation process to convert ethane to ethylene, in the presence of oxygen, with a catalyst comprising nickel oxide. The selectivity and the conversion of the process are greater than 85% and 15%, respectively." Office Action, page 6. The Examiner concludes that, although "Ji does not specifically disclose that the catalyst comprises at least 50% of nickel oxide," it would have been an obvious to one of ordinary skill in the art at the time the invention was made to modify the Ji

process because "it is known in the art that a catalyst comprising nickel oxide is effective in an oxidative dehydrogenation process to convert ethane to ethylene." Id. Applicant traverses.

The present invention teaches, *inter alia*, methods for the dehydrogenation of alkanes using a catalyst containing nickel oxide as a major component. Applicant's methods provide enhanced performance, i.e., selectivity and conversion, for the conversion of an alkane to an alkene over a broad temperature range, including in preferred embodiments, at temperatures of about 400 °C or less. In contrast, Ji refers to methods for oxidative dehydrogenation of ethane using Li/X/CaO catalysts at temperatures greater than 550°C, where "X" is a Group VIII element. Importantly, the catalysts used in the Ji process contain at most about 33% nickel oxide. See, Ji, page 122. Nowhere does Ji make mention of catalyst compositions containing nickel oxide as a major component. Thus, Ji fails to teach all of applicant's claim elements.

Further, there is no motivation to modify the Ji process in the way suggested by the Examiner. While Ji teaches that Li/Ni/CaO catalysts have high ethane conversion and ethylene selectivity at high temperatures, Ji also

teaches that other nickel oxide containing catalysts (e.g., Ni/CaO catalysts) are non-selective for the formation of ethylene. See, Ji, page 125. Thus, a fair reading of Ji is limited to nickel being an effective dopant in Li/CaO catalysts. Therefore, Ji does not, in any way, provide the requisite motivation to use catalysts containing at least 50% nickel oxide in a dehydrogenation process, as required by applicant's claims.

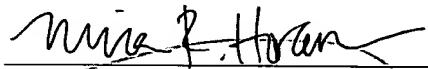
Moreover, a person of ordinary skill in the art would not have been motivated to modify the process taught by Ji in a manner that would have led to the inventions defined by new claims 68 and 69. Specifically, Ji teaches that their catalyst - having Nickel oxide only as a dopant - performs advantageously only at temperatures significantly higher than 400 °C. Hence, a skilled artisan would not have been led to applicant's invention.

For at least the reasons detailed above, Ji fails to render applicant's claims obvious. Accordingly, applicant requests that the Examiner withdraw the 35 U.S.C. § 103(a) rejection of claims 1-5, 11-13 and 15.

CONCLUSION

In view of the foregoing amendments and remarks, applicant requests that the Examiner withdraw the claim rejections and allow all claims of this application. If the Examiner believes that an interview would facilitate the resolution of any outstanding issues, he is kindly requested to contact the undersigned.

Respectfully submitted,



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APPENDIX TO AMENDMENTS

IN THE CLAIMS:

Please amend the claims as follows:

1. (Twice Amended) A method comprising contacting an alkane having from 2 to 4 carbon atoms to a catalyst that includes at least about 50% nickel oxide by weight and dehydrogenating said alkane with a selectivity of greater than 70% and a conversion of greater than 10%.

6. (Twice Amended) A process for the oxidative dehydrogenation of an alkane having from 2 to 4 carbon atoms comprising contacting said alkane in the presence of oxygen to a compound that includes at least about 50% nickel oxide by weight at a temperature of less than or equal to about 400°C and obtaining a selectivity in said dehydrogenation of greater than 70% and a conversion of greater than 10%.

7. (Amended) The [method] process of claim 6 wherein said selectivity is greater than 75%.

8. (Amended) The [method] process of claim 7 wherein said selectivity is greater than 80%.

9. (Amended) The [method] process of claim 8 wherein said selectivity is greater than 85%.

12. (Amended) The [method] process of claim 11
wherein said selectivity is greater than 75%.

13. (Amended) The [method] process of claim 12
wherein said selectivity is greater than 80%.

14. (Amended) The [method] process of claim 13
wherein said selectivity is greater than 85%.

15. (Twice Amended) The [method] process of claim
11 wherein said conversion is greater than 15%.

67. (Twice Amended) A method for the oxidative
dehydrogenation of ethane to ethylene, optionally with
ethylene as a co-feed with said ethane, comprising contacting
ethane in the presence of oxygen to a catalyst that includes
at least about 50% nickel oxide $[(\text{NiO})]$ by weight with either
niobium oxide $[(\text{Nb}_2\text{O}_5)]$ or tantalum oxide $[(\text{Ta}_2\text{O}_5)]$.